FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

FIG. 7

DIRECTION OF BACK TANGENT
LENGTH k_1

DIRECTION OF BACK TANGENT
LENGTH k_2

P'

θ_1 θ_2

P_1 P_2

K

FIG. 8A

V

P'

Q_1 Q_2 L_2

L_1 θ_1 θ_2

P_1 P_2

FIG. 8B

DIRECTION OF BACK TANGENT
LENGTH K_1

P' k_2'

Q_2' L_2'

L_1' Q_1' θ_2

θ_1' P_2'

P_1'

FIG. 8C

$$\boxed{\text{CONTROL POINT COMPUTATION PROCESSING}}$$

$$
\begin{aligned}
k_1 &= \sin\theta_2 / (\sin\theta_2 \cos\theta_1 + \cos\theta_2 \sin\theta_1) \\
k_2 &= \sin\theta_1 / (\sin\theta_2 \cos\theta_1 + \cos\theta_2 \sin\theta_1)
\end{aligned}
$$

S1

$$s = \cos\theta' = (\cos\theta_1 + \cos\theta_2)/2$$

S2

$$
\begin{aligned}
L_1 &= K \times k_1 \times 2 \times s \times 2/(3(1+s)) \\
L_2 &= K \times k_2 \times 2 \times s \times 2/(3(1+s))
\end{aligned}
$$

S3

$$\boxed{\text{STOP}}$$

FIG. 9

$\theta_1 = 18$ $\theta_2 = 18$

FIG. 10A

FIG. 10B

θ₁=18   θ₂=22

FIG. 11A

FIG. 11B

$\theta_1 = 28$ $\theta_2 = 32$

R(t)

1.2

1

0.8
 0   0.2   0.4   0.6   0.8   1   1.2
                                        t

FIG. 12A

ry(t)

0.4

0.2

0

-0.2

-0.4
 0   0.2   0.4   0.6   0.8   1
                                   t

FIG. 12B

$\theta_1=20 \qquad \theta_2=60$

R(t)

FIG. 13A

ry(t)

FIG. 13B

FIG. 14

FIG. 15

FIG. 16

b

P

2

1

a

3

4

FIG. 17(A)

5

5

5

Y

FIG. 17(B)

FRAME LINE INTERPOLATION NORMAL VECTOR

POLYGON BEFORE INTERPOLATION

CURVED SURFACE INTERPOLATION NORMAL VECTOR B

FIG. 18

CURVED SURFACE
INTERPOLATION
NORMAL VECTOR

FRAME LINE
INTERPOLATION
NORMAL VECTOR

FIG. 19(A)

FIG. 19(C)

FIG. 19(B)

FIG. 19(D)

SPLITTING POLYGON DATA GENERATION PROCESSING

ANY INPUT OF VERTICES AND FRAME LINE INTERPOLATION NORMAL VECTORS? — S11 — N

Y

MEMORY — S12

CONFIRMATION? — S13

N

CURVE DISPLAY — S14

ADDITIONAL INPUT? — S15

Y

N

CURVED SUFACE GENERATION — S16

COMPUTATION OF FRAME LINE INTERPOLATION NORMAL VECTORS AND CURVED SURFACE INTERPOLATION NORMAL VECTORS — S17

VECTOR COALESCENCE PROCESSING — S18

SPLITTING DATA GENERATION — S19

STOP

FIG. 20

NORMAL VECTOR

VERTEX

FIG. 21

P_1 A_1 P_2 A_2 P_3 A_3 P_4 A_4

FIG. 22(A)

B_1 P_1 B_2 P_2 B_3 P_3 B_4 P_4

FIG. 22(B)

FIG. 23

FIG. 24

FIG. 25(A)

FIG. 25(B)

FIG. 26A

1 REFERENCE DATA

#1	#2	...	#i		#1	...	#i

POLYGON DATA #1	POLYGON DATA #2	POLYGON DATA #i	...	POLYGON DATA #I
2	3	4		5

FIG. 26B

6 COORDINATES OF VERTICES

$\begin{pmatrix} px_1 \\ py_1 \\ pz_1 \end{pmatrix}$	$\begin{pmatrix} px_2 \\ py_2 \\ pz_2 \end{pmatrix}$	$\begin{pmatrix} px_3 \\ py_3 \\ pz_3 \end{pmatrix}$	...
1	2	3	...

7 NORMAL VECTORS

$\begin{pmatrix} nx_1 \\ ny_1 \\ nz_1 \end{pmatrix}$	$\begin{pmatrix} nx_2 \\ ny_2 \\ nz_2 \end{pmatrix}$	$\begin{pmatrix} nx_3 \\ ny_3 \\ nz_3 \end{pmatrix}$
1	2	3

...

9 OTHER DATA

FIG. 26C

NUMBER OF VERTICES	REFERENCE DATA FOR VERTEX #1	REFERENCE DATA FOR VERTEX #2	...	REFERENCE DATA FOR VERTEX #i
10	11	12	13	

FIG. 26D

INDEX OF COORDINATES	INDEX OF INTERPOLATION VECTOR A	INDEX OF INTERPOLATION VECTOR B	INDEX OF CURVED SURFACE INTERPOLATION NORMAL VECTOR
14	15	16	17

(FINE SPLITTING PROCESSING)

S21:
GENERATE (M-1) INTERPOLATED VERTICES P_{12} BETWEEN P_1 AND P_2 AND DETERMINE CURVED SURFACE [INTERPOLATION] NORMAL VECTORS n_{12} AT INTERPOLATED VERTICES P_{12}
(SPLITTING PROCESSING OF FRAME LINE $P_1 P_2$)

S22:
GENERATE (M-1) INTERPOLATED VERTICES P_{34} BETWEEN P_3 AND P_4 AND DETERMINE CURVED SURFACE INTERPOLATION NORMAL VECTORS AND n_{34} AT INTERPOLATED VERTICES P_{34}
(SPLITTING PROCESSING OF FRAME LINE $P_3 P_4$)

S23:
GENERATE (N-1) INTERPOLATED VERTICES P_{13} BETWEEN P_1 AND P_3 AND DETERMINE CURVED SURFACE INTERPOLATION NORMAL VECTORS n_{13} AT INTERPOLATED VERTICES P_{13}
(SPLITTING PROCESSING OF FRAME LINE $P_1 P_3$)

S24:
GENERATE (N-1) INTERPOLATED VERTICES P_{24} BETWEEN P_2 AND P_4 AND DETERMINE CURVED SURFACE INTERPOLATION NORMAL VECTORS n_{24} AT INTERPOLATED VERTICES P_{24}
(SPLITTING PROCESSING OF FRAME LINE $P_2 P_4$)

S25:
GENERATE (M-1)x(N-1) INTERPOLATED VERTICES P_{1234} BETWEEN P_{12} AND P_{34} AND DETERMINE CURVED SURFACE INTERPOLATION NORMAL VECTORS n_{1234} AT INTERPOLATED VERTICES P_{1234}, OR GENERATE (M-1)x(N-1) INTERPOLATED VERTICES P_{1324} BETWEEN P_{13} AND P_{24} AND DETERMINE CURVED SURFACE INTERPOLATION NORMAL VECTORS n_{1324} AT INTERPOLATED VERTICES P_{1324}
(SPLITTING PROCESSING INSIDE POLYGONS)

S26:
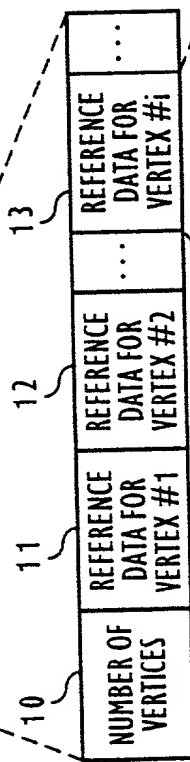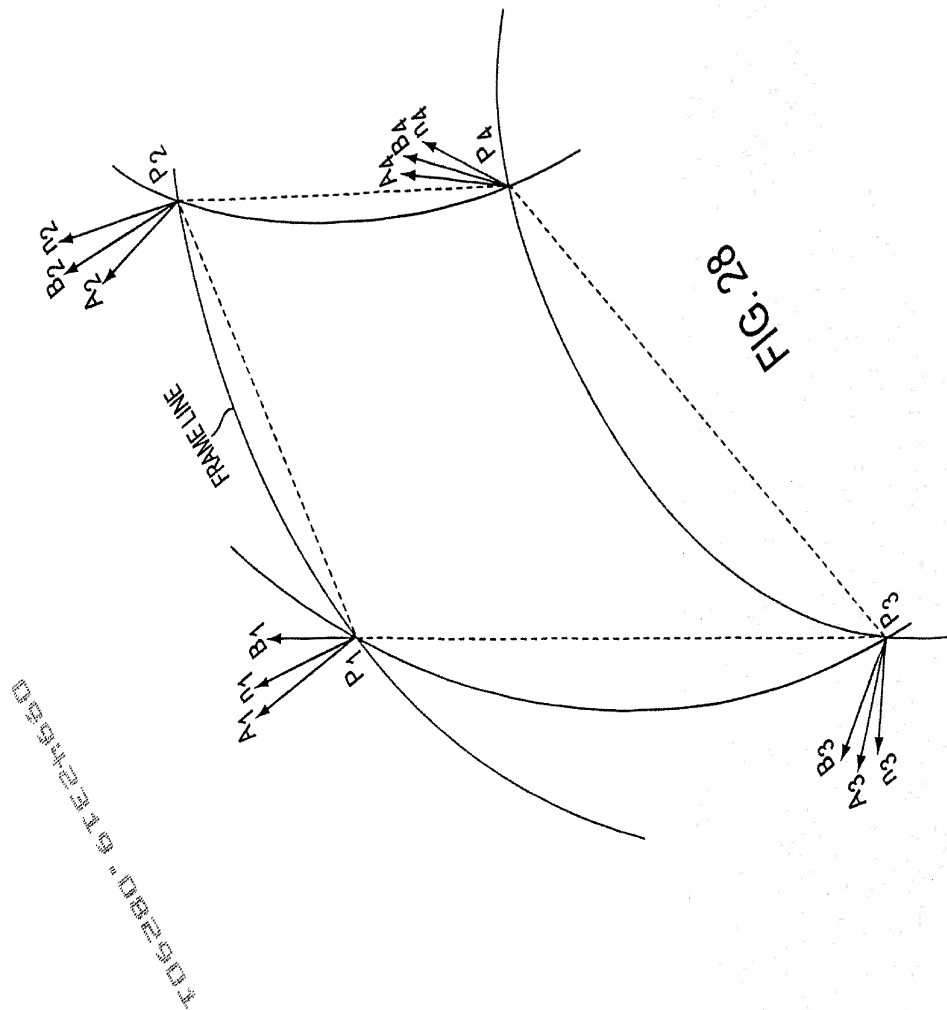POLYGON SPLITTING BY INTERPOLATED VERTICES

STOP

FIG. 27

FIG.28

FRAME LINE

FIG. 29

FIG. 30

FIG. 31

FIG. 32

FIG. 33

SPLITTING PROCESSING OF FRAME LINES

S31:
DETERMINE STRAIGHT LINE $P_1 P_2$

S32:
PROJECT STRAIGHT LINE $P_1 P_2$ ONTO THE PLANE THAT INCLUDES POINT P_1 OR P_2 AND IS PERPENDICULAR TO THE FRAME LINE INTERPOLATION NORMAL VECTOR, AND TAKE THE STRAIGHT-LINE DIRECTION VECTOR PROJECTED ONTO EACH PLANE AS THE TANGENT VECTOR

S33:
DETERMINE THE ANGLE θ_1, OR θ_2 BETWEEN STRAIGHT LINE $P_1 P_2$ AND THE TANGENT VECTOR AT POINT P_1 OR P_2, RESPECTIVELY

S34:
BASED ON θ_1, OR θ_2, DETERMINE DISTANCE L_1 OR L_2 FROM POINT P_1 OR P_2 TO BEZIER CURVE CONTROL POINT Q_1 OR Q_2, RESPECTIVELY

S35:
DETERMINE CONTROL POINTS Q_1, Q_2 FROM THE TANGENT VECTORS AND L_1, L_2

S36:
DETERMINE INTERPOLATED VERTEX P_{12} ON THE BEZIER CURVE OBTAINED FROM CONTROL POINTS P_1, P_2, Q_1, Q_2, AND CONNECTION VECTOR s_{12} AND CURVE INTERPOLATION NORMAL VECTOR nn_{12} AT INTERPOLATED VERTEX P_{12}
[TRANSLATOR'S NOTE: AS SUGGESTED BY THE SPELLINGS IN S37 BELOW AND IN THE MAIN TEXT, "CONNECTION VECTOR s_{12}" IS PROBABLY A MISPRINT FOR "TANGENT VECTOR s_{12}", AND "CURVE INTERPOLATION NORMAL VECTOR nn_{12}" IS PROBABLY A MISPRINT FOR "CURVED SURFACE INTERPOLATION NORMAL VECTOR nn_{12}".]

S37:
CORRECT CURVED SURFACE INTERPOLATION NORMAL VECTOR nn_{12} BY TANGENT VECTOR s_{12}

STOP

FIG. 34

SPLITTING PROCESSING WITHIN POLYGONS

S41:
DETERMINE STRAIGHT LINE $P_1 P_2$

S42:
PROJECT STRAIGHT LINE $P_1 P_2$ ONTO THE PLANE THAT INCLUDES POINT P_1 OR P_2 AND IS PERPENDICULAR TO THE CURVED SURFACE INTERPOLATION NORMAL VECTOR, AND TAKE THE STRAIGHT-LINE DIRECTION VECTOR PROJECTED ONTO EACH PLANE AS THE TANGENT VECTOR

S43:
DETERMINE THE ANGLE θ_1 OR θ_2 BETWEEN STRAIGHT LINE $P_1 P_2$ AND THE TANGENT VECTOR AT POINT P_1 OR P_2, RESPECTIVELY

S44:
BASED ON θ_1, OR θ_2, DETERMINE DISTANCE L_1 OR L_2 FROM POINT P_1 OR P_2 TO BEZIER CURVE CONTROL POINT Q_1 OR Q_2, RESPECTIVELY

S45:
DETERMINE CONTROL POINTS Q_1, Q_2 FROM THE TANGENT VECTORS AND L_1, L_2

S46:
DETERMINE INTERPOLATED VERTEX P_{12} ON THE BEZIER CURVE OBTAINED FROM CONTROL POINTS P_1, P_2, Q_1, Q_2, AND CONNECTION VECTOR s_{12} AND CURVE INTERPOLATION NORMAL VECTOR nn_{12} AT INTERPOLATED VERTEX P_{12}
[TRANSLATOR'S NOTE: AS SUGGESTED BY THE SPELLINGS IN S47 BELOW AND IN THE MAIN TEXT, "CONNECTION VECTOR s_{12}" IS PROBABLY A MISPRINT FOR "TANGENT VECTOR s_{12}", AND "CURVE INTERPOLATION NORMAL VECTOR nn_{12}" IS PROBABLY A MISPRINT FOR "CURVED SURFACE INTERPOLATION NORMAL VECTOR nn_{12}".]

S47:
CORRECT CURVED SURFACE INTERPOLATION NORMAL VECTOR nn_{12} BY TANGENT VECTOR s_{12}

STOP

FIG. 35

SPECIFICATION OF POLYGONS AND NORMALS OF A CUBE

FIG. 36

FIG. 37

FIG. 38

FIG. 39

FIG. 40

FIG. 41

FIG. 42

```
                    ┌─────────────┐
                    │    START    │
                    └──────┬──────┘
          ┌────────────────▼────────────────┐
          │  │  GEOMETRY PROCESSING         │⟍ S51
          │  └──────────────┬──────────────┘
          │  ┌──────────────▼──────────────┐
          │  │  FINE SPLITTING PROCESSING   │⟍ S52
          │  └──────────────┬──────────────┘
          │  ┌──────────────▼──────────────┐
          │  │  PERSPECTIVE TRANSFORMATION  │⟍ S53
          │  └──────────────┬──────────────┘
          │  ┌──────────────▼──────────────────────────────────────┐
          │  │ BRIGHTNESS CALCULATION (SHADING), TEXTURE ADDRESS CALCUALTION │⟍ S54
          │  └──────────────┬──────────────────────────────────────┘
          │  ┌──────────────▼──────────────┐
          │  │  DRAWING                     │⟍ S55
          │  └──────────────┬──────────────┘
          └────────────────┘
```

FIG. 43

FIG. 44

GPU115

FRAME
BUFFER

Z
BUFFER

TEXTURE
MEMORY

141

142

143

118 GRAPHICS MEMORY

FIG. 45